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Transportation Test With White Rose Potatoes From Kern County, California to New York City, May [illegible], 1948

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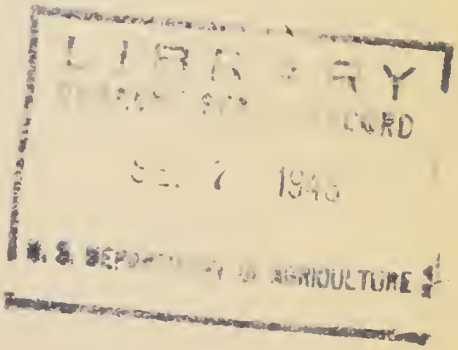


Beltsville, Maryland
June 7, 1948

TRANSPORTATION TEST WITH WHITE ROSE POTATOES FROM KERN COUNTY, CALIFORNIA TO NEW YORK CITY

The objects of this test were to determine (1) the relative effectiveness of standard refrigeration and various types of modified refrigeration used in shipping potatoes from Kern County, California, to eastern markets; (2) the relative effectiveness of fan cars and standard cars for shipping new potatoes; (3) the carrying quality of precooled (hydrocooled) new potatoes. The methods of refrigeration used with different cars and the details of icing are shown in Table 1. The pre-cooling was done in a vat of water cooled by mechanical refrigeration to a temperature of 35° to 40°F. The vat was large enough to hold several thousand pounds of potatoes which were dumped into it in bulk as they came from the field. This hydrocooling lasted ten to twenty minutes before the potatoes were picked up by a conveyor and moved to the grading belt.

The cost of refrigeration for the various cars was as follows:

Cars 1 and 2,	Standard Refrigeration Rule 200	$101.20
" 3,4,5 and 6,	Initial icing, 1 reicing in transit, Rule 247	61.99
" 7,8 and 9,	Preiced, replenished and reiced once in transit, Rule 254	68.31
Car 10,	Dry car loaded, initially iced at Needles, Rule 240	47.01
" 11,	Dry car loaded, initially iced at Agrentine, Rule 240	46.56

To the cost of refrigeration for Cars 10 and 11 should be added $20.00 per car to cover the cost of hydrocooling.

Test Cars

All of the cars used were regular forty-foot end-bunker cars. Two were equipped with Preco fans. All were steel sheathed, and had three inches of insulation in walls and three and one-half inches in roof and floor. They had insulated bulkheads and 6" floor racks, except fan cars 2 and 9 which had 7 1/2" floor racks.

Temperature and Icing Records

The temperatures of the potatoes in the loads and of the air above and below the loads were taken at railway division points en route by means of electric resistance thermometers that could be read from the roof of the car without opening the doors. For commodity temperatures these were inserted into tubers in top, middle, and bottom layer of the middle row of bags at the bunker (first), quarter-length (sixth), and doorway (eleventh) stack. Inside air temperatures were taken under the floor rack at the bunker, above the load at the bunker and at the doorway. Recording thermometers were placed near the top bulkhead opening in fan cars 2 and 9 to obtain the temperature of the air while the cars were in motion as well as when standing. A recording thermometer was also attached outside and underneath one of the cars to obtain a record of outside air temperatures.

Whenever the cars were iced, fresh, unbroken blocks of known average weight were used, and the amount was calculated by block count. The blocks were broken into 50 to 100 pound pieces for filling the bunkers. The amount of ice remaining in the bunkers at destination was calculated on the basis of the bunker capacity and depth of ice remaining. All of the cars had bunker capacity of 11,500 pounds of chunk ice.

Loading

All but one car were loaded with 340 - 100-pound bags. The 3 x 5 "tramped" load which was used consists of three rows of bags crosswise of the car, five layers high and eleven stacks long, with thirty bags wedged four layers high in the doorway; all bags laid horizontal (figure 1). The height of the load was 53" for five layers and 43" for the 4 layers at the doorway. The loads settled six to seven inches during transit. Car 10 was loaded with 3,600 ten-pound bags, all placed horizontally, and crosswise of the car.

Cars 6, 7, 8 and 9 were iced the day before loading (pre-iced); thus the ventilators were closed from initial (pre) icing, May 20, to destination. Cars 1, 2, 4 and 5 were spotted for loading with no ice in the bunkers (dry cars) and were forwarded with ventilators open (standard vent) until they were initially iced at Bakersfield on May 22. Car 3 was handled similarly, except that it was forwarded with vents open to Needles, where they were closed and the car was initially iced. Cars 10 and 11 were spotted for loading dry (without ice). Since they were loaded with pre-cooled potatoes, the vents were kept closed from the shipping point, and the cars were not initially iced until arrival at Needles and Argentine respectively.

Loads

The potatoes making up the commercial loads were U.S. No. 1 washed White Rose. Those in car 6 were B size and fairly well matured, with less skinning than in the other cars. The potatoes in all other cars were moderately to severely skinned, with over half showing 40 to 80 per cent of the surface skinned. There was no decay or surface browning at time of loading. The potatoes in car 5 had considerable scab and those in cars 1, 3 and 7 had a trace of Rhizoctonia. All loads had 1 to 4 per cent mechanical injury, mostly digger cuts, and some greening (sunburn).

Eighteen comparable 50-pound bags of potatoes dug from the same field, were used as test bags in cars refrigerated in different ways. The commercial loads of cars 1, 3 and 7 were from this same field as the test bags. Three of the test bags were placed on top of the load at the doorway in cars 1, 2, 3, 7, 9 and 10. They were inspected for weight loss and change in condition upon arrival at the market, and after holding several days under market conditions.

Weather and Route

The loading day was unusually cool, with temperatures below 65°F. during most of the morning, and a maximum of only 75°F. Weather such as this is more nearly that prevailing in April and early May than that in late May. However, the weather en route was fairly normal for this time of the year. Maximum temperatures of 85° to 95° were encountered in Arizona, 70° to 80°F. in New Mexico and 80° to 90°F. from Amarillo, Texas to Jersey City. Minimum temperatures outside ranged from 50° to 63° (see figure 2).

The cars were routed via Santa Fe and Pennsylvania Railroads. They left Bakersfield at 1:45 P.M., May 22 and arrived Corwith Yards, Chicago at 3:15 P.M. May 27. They left Chicago at 9:30 A.M., May 28 and arrived at Jersey City 10:00 P.M., May 30 (Table 2).

R E S U L T S

Condition of Commercial Loads

There was practically no difference in the condition of the potatoes of the non-precooled loads (cars 1 to 9) refrigerated according to Rules 200, 247, 254 upon arrival at the market that could be attributed to the type of refrigeration used. In cars 4 and 5 two per cent of the potatoes had bacterial soft rot but in the other cars this rot amounted to less than one-half of one per cent. In general, the rot followed transit bruising and was not in an advanced stage. In car 5 there was about 15 per cent sunken scab. This disease is of field origin and is not affected by conditions in transit.

The hydro-cooled potatoes (cars 10 and 11 shipped with vents closed and bunkers dry to Needles or Argentine) showed a big difference in condition upon arrival. Car 10 that was initially iced at Needles, arrived sound, whereas Car 11 that was not initially iced until three days later at Argentine, averaged 8 per cent advanced bacterial soft rot in most bags and 40 per cent in about 30 of the middle layer bags.

Bruising and bag marking were prevelant in all cars and spoiled the appearance of 10 to 20 per cent of the potatoes. The areas that were bruised and skinned turned brown in transit and continued to darken into very unattractive spots after removal from the car. This type of injury occurred in all layers of the load and was undoubtedly caused by rubbing and shifting in transit due to lengthwise slack which occurs in a bumped load. Holes were rubbed in many bags en route and the loads settled 6 to 7 inches. An outstanding exception was car 10, which was loaded with ten-pound bags set by hand, with each bag firmly nested in place. There was very little evidence of shifting in this load and although the tubers in the bottom layers showed bag marks from pressure of the load, there were very few abrasions and discolored spots.

The type of packing house equipment and handling methods used are noted in tables 3 and 4. Further testing is necessary to determine what effect if any, they have on market condition. Owing to the cool weather on loading day, there was little difference in surface browning of skinned bud ends of the tubers picked up in canvas bags and those picked up in burlap bags. If the day had been hot and windy a pronounced difference would have been expected.

Condition of Test Lots

The California inspection of the potatoes used for test lots shows the following:

Maturity - approximately 50 per cent of tubers with 5 per cent to 20 per cent of surface skinned; approximately 35 per cent with 20 per cent to 50 per cent of surface skinned, remainder with 40 per cent to 90 per cent of surface skinned.

Defects - - - 2.5 per cent mechanical injury; .5 to 1 per cent sunburn (greening); .5 per cent worm damage; 0.5 per cent growth

cracks, slight Rhizoctonia and traces of stem end browning. 95 percent U. S. No. 1 quality.

A summary of the condition upon arrival at New York and after holding on the market for two to three days is shown in table 5. The detailed inspection of the individual bags showed a very wide variation in the amount of browning in different bags from a single car, thus preventing most differences from being statistically significant. However, it is obvious from the data that both severe browning and moderate browning increased during holding on the market. There seemed to be little difference in browning that could be traced to the icing method used. In most instances the corking over of the skinned areas was considered good upon arrival. This "new skin" was pliable and could not be rubbed off easily. After holding for two to three days only the potatoes from the Standard Refrigeration cars (cars 1 and 2) and from the hydro-cooled car (car 10) had good new skin. Poor new skin, i.e. papery and brittle, with wilting at the bud end, was found in the lots from cars 3 and 7. Normal healing of wounds and the development of good new skin of potatoes are retarded or prevented if conditions are too dry or too cold. Shipping with vents open to Needles may have had an adverse drying effect on the potatoes in car 3 and pre-icing car 7 may have caused too low a temperature for cork formation. The hydro-cooled potatoes in cars 10 and 11 had a chance to warm up somewhat before they were iced and as a result were able to develop good new skin.

Weight Loss

The weight losses in several cars were determined from the three fifty-pound test bags placed at the top doorway position (table 6). The loss was least in the hydro-cooled load (car 10 - iced at Needles), amounting to 1.3 percent in transit compared with 3.2 and 3.1 percent in cars 1 and 2 under Standard Refrigeration and 3.6 percent in car 3, under Rule 247. The loss was 2.3 percent in pre-iced car 7, under Rule 254. There was very little difference in weight loss in fan car 2 and non-fan car 1, both under Standard Refrigeration. The potatoes continued to lose weight from evaporation of moisture during holding at the market, but the lots maintained the same relative position regarding loss that they had upon arrival.

Transit Temperatures

The temperatures recorded in the different cars are shown graphically in figures 2 to 15.

At time of loading the potatoes in cars 1 to 9 ranged from 56° to 67°F. (table 3). In pre-iced cars 6 to 9 considerable cooling occurred immediately, resulting in average load temperatures of 48° to 54° at Bakersfield near noon the next day. In dry cars 1 to 5 that were forwarded to Bakersfield with vents open, the average load temperature at Bakersfield ranged from 61° to 66°. Car 3, which was forwarded with vents open to Needles, had an average load temperature of 62° at this point at 6:00 A.M., May 23, before it was initially iced. The load average of these "dry" cars reached the 45° to 50° range within 48 hours after icing, and continued to drop gradually in cars 1, 3, 4 and 5 to the 42° to 45° range, and in car 2 to the 36° to 42° range, mostly below 40° for the remainder of the trip. The pre-iced cars also maintained temperatures [illegible] after the initial cooling period. The average temperature of the potatoes in the hydro-cooled cars was reduced from about 70° to 48° during hydro-cooling and icing, but since they were forwarded with vents closed to Needles and Kingman respectively before they were

initially iced, they warmed up en route. Car 10 had an average temperature of 52° at Needles, before icing, and Car 11 warmed up to 58° en route to Argentine before it was iced. Both cars cooled normally. Car 10 reached 40° about 3 days after icing and then ranged up to 44° during the remainder of the trip. Car 11 cooled to 43° about 3 days after icing and maintained that temperature during the remainder of the trip. The spread of temperature within the load in the non-fan cars was 16° - 22° during the cooling down period and 6° - 10° during the last part of the trip. The coldest spot was usually at the bottom bunker position and the warmest spot at the top quarterlength. In fan cars the greatest spread in temperature during the cooling down period was 13° for car 2 (loaded dry) and 19° for car 9 (pre-iced). Toward the end of the trip the greatest spread was 11° for car 2 and 5° for car 9. 1/ In these cars the top layer was slightly colder than the bottom layer.

Comparison of Rules 200 - 247 - and 254

The only difference in average load temperature of potatoes shipped under Standard Refrigeration (Car 1 - Rule 200), initially iced at Bakersfield - reiced at Argentine (Car 5 - Rule 247), and preiced, replenished at Bakersfield and reiced at Argentine (Rule 254, Car 7) was in the rate at which the loads cooled (figure 13 A). The 50°F. level which is considered most desirable for potatoes was reached in pre-iced car 7 about 24 hours after loading whereas it took 48 hours in the other two cars.

Comparison of Various Icings Under Rule 247

Under Rule 247 car 3 was iced at Needles and Corwith. Car 4 was iced at Bakersfield and Argentine and Car 6 was preiced before loading and reiced at Belen. These are compared in figure 13 B. Initial icing at Needles brought the average temperature of the load to 50° at Belen, 72 hours after loading. Initial icing at Bakersfield brought the average temperature down to 50° at Needles, 48 hours after loading. Preicing brought the average temperature to 50° between Bakersfield and Needles, about 30 hours after loading.

Comparison of Fan Cars and Non Fan Cars

The average temperatures of the load in fan car 2 and non fan car 1, both under Standard Refrigeration are shown in figure 14 A and of fan car 9 and non-fan car 8, iced the same under Rule 254, are shown in figure 14 B. Slightly lower temperatures were obtained in fan car 2 but all maintained satisfactory temperatures for potatoes.

Comparison of Hydrocooled Loads

Average temperatures of hydrocooled loads in Car 10, initially iced at Needles, and Car 11, initially iced at Argentine, are shown in figure 14 C. The rapid cooling during hydrocooling before loading is clearly evident as well as the warming up that occurred en route while the cars were without ice, with vents closed. As mentioned before Car 10 iced at Needles arrived sound whereas Car 11 with icing delayed until Argentine and temperatures above 50°F. for the 5 day run between Bakersfield and Corwith arrived with heavy decay.

1/ The apparent rise in maximum temperature in Car 2 toward the end of the trip was probably caused by a defective thermometer. The actual spread was probably about 4°.

Comparison of Standard Refrigeration and Rule 254 in Fan Cars

Standard refrigeration and Rule 254 in fan cars are compared in figure 15. The average temperature of Car 9, which was preiced, replenished at Bakersfield and reiced at Argentine dropped more rapidly during the first three days than that of Car 2 which received standard refrigeration. During the rest of the run the average temperature of Car 9 was 3°-5° higher than that of Car 2. Car 2 reached 50° only 12 hours later than Car 9 which was preiced. The temperature of both cars was lowered rapidly enough, but the final temperatures obtained by Standard refrigeration were lower than necessary. Possibly satisfactory temperatures would have been obtained by Rule 247 with the initial icing at Bakersfield after loading and one reicing at Argentine.

Icing Records

The amount of ice supplied each car and estimates of amounts remaining at various points en route and at destination are shown in table 7. Meltage was fairly slow owing to the relatively low temperature at time of loading and moderate weather en route. Ice supplied ranged from 11,500 pounds with hydrocooled potatoes under Rule 240 (Cars 10 and 11) to 26,875 pounds under Standard refrigeration (fan car 2). The temperatures reached in Car 2 were much lower than necessary. Ice remaining at destination ranged from 500 pounds in Car 10 (Rule 240) to 9,500 pounds in Car 1 (Standard Refrigeration). There remained 3600 to 5700 pounds of ice in cars 3 to 6 shipped under initial icing with one reicing in transit (Rule 247). The greatest ice meltage was in Car 7 which was preiced, replenished after loading and reiced at Argentine. In fan car 2, loaded dry, but under Standard Refrigeration from Bakersfield, the meltage was almost as much but the average temperature maintained was considerably lower. The least ice meltage was in Car 11 with hydrocooled potatoes, initially iced at Argentine, which was the only car that showed serious decay upon arrival.

Commercial Considerations

With the weather conditions prevailing during this test, transit temperatures were as satisfactory under Rule 247 with initial icing at Bakersfield and one reicing at Argentine as those obtained with Standard refrigeration. With considerably warmer weather it might be desirable to reice twice - at Belen and Corwith - in place of once at Argentine.

Loading pre-iced cars resulted in somewhat faster cooling of the load but was of no practical advantage so far as the condition of the potatoes on arrival was concerned.

Fan cars with fans on were more satisfactory than non-fan cars because the operation of the fans gave more uniform and desirable temperatures throughout the load and prevented maximum temperatures as high as those that prevailed in non-fan cars. The browning effect of air drafts on skinned potatoes was probably nullified by the high humidity prevailing in these cars. Icing by Rule 247 may result in a more nearly optimum temperature range than Standard Refrigeration or Rule 254 as used in this test.

Hydro cooling removed the field heat from the potatoes before they were loaded. Delaying icing of hydrocooled potatoes until the load warmed up to 50°F. (Needles) was satisfactory in this test and utilized most of the ice, but prolonging the time without ice to Argentine, by which time the average temperature reached 70°, resulted in serious decay (bacterial soft rot).

There was no commercial difference in the surface bud-end browning of skinned areas under the different methods of icing used in the test. The new skin was apparently good upon arrival but after holding for 3 days it was brittle in most lots and after 6 days it was brittle on all lots and the flesh beneath was spongy. This indicates that the temperature and humidity conditions in none of the cars were ideal for the development of new skin. Since the conditions needed for the formation of true new skin - 60°F. or higher with high humidity - also favor bacterial soft rot the refrigeration practice should be aimed toward low temperature to control rot rather than the higher temperature needed for new skin formation with accompanying danger of rot.

Weight loss in transit is likely to be high whenever severely skinned potatoes are shipped. In this test it ranged from 1.7 per cent in hydrocooled potatoes (car 10) to 4.3 per cent in cars 1, 2, 3 and 9.

Transit bruising spoiled the appearance of more potatoes in the commercial loads than did surface browning of skinned bud ends. If bruising is due to lengthwise slack in the present load the market quality probably could be enhanced greatly by using a better method of loading.

Acknowledgements

The test was made possible through the cooperation of the growers, packers and shippers mentioned in the various tables of this report, the Kern County Potato Growers Association, Sid Carmine, Secretary, M. A. Lindsay, Kern County Farm Advisor and the Santa Fe and Pennsylvania Railroads.

Assistance in loading the test cars was given by Dave Wright, Assistant Farm Advisor, Kern County, Calif., L. L. Morris and I. L. Baks, Calif. Agricultural Experiment Station, Davis, Calif., E. A. Berner, Fresco Inc., C. T. Pentzer and D. H. Dewey, U. S. Department of Agriculture, Fresno, Calif.

Assistance in unloading the cars at the destination was given by: J. S. Wiant, J. Kaufman, H. Hruschka, [illegible] A. Radspinner, and F. A. Friedman, U. S. Department of Agriculture, New York City.

The test cars were accompanied by [illegible] B. Berner, U.S.D.A., Fresno, Calif., M. A. Smith, U.S.D.A., Chicago, Ill., [illegible] U.S.D.A., Beltsville, Md. from loading point to destination, by [illegible] Barbank, Santa Fe Refrigeration Dept. from loading point to Belen, N. Mexico; by F. M. Robinson, Santa Fe Refrigeration Dept. from Belen, New Mexico to Corwith, Ill. and by [illegible] Patterson, Fruit Growers Express Company and [illegible] Hotsor, Pennsylvania Railroad from Clearing, Ill. to New York City.

TABLE NO. 1
LIST OF TEST CARS

Car	S.F.R.D.	Refrigeration	Rule	Shipper
1	34874	Dry car loaded - Vents open to Bakersfield - Standard refrigeration, vents closed, Bakersfield to destination.	200	F. H. Vahlsing
2	14488	Fan car, fans on - Same icing as carl.	200	Atlantic Commission Co.
3	35221	Dry car loaded - Vents open to Needles - Initial ice and vents closed at Needles - Re-ice at Corwith, Ill.	247	F. H. Vahlsing
4	34315	Dry car loaded - Vents open to Bakersfield - Initial ice and vents closed at Bakersfield - Reice at Argentine, Kansas.	247	Baumel & Kurtz
5	32016	Same as car 4.	247	Atlantic Commission Co.
6	33083	Car pre-iced and vents closed before loading - Re-iced at Belen, N. M.	247	Geo. R. Craig Co.
7	35403	Car pre-iced and vents closed before loading - Replenished after loading - Re-iced at Argentine, Kansas.	254	F. H. Vahlsing
8	35616	Same as car 7.	254	Ritter Price Co.
9	4403	Fan car, fans on - same icing as cars 7 and 8.	254	Baumel & Kurtz
10	36586	Hydrocooled potatoes loaded in dry car - shipped vents closed. Initial ice Needles, California.	240	Atlantic Commission Co.
11	33251	Hydro-cooled potatoes loaded in dry car - shipped vents closed. Initial ice Argentine, Kansas.	240	Geo. R. Craig Co.

TABLE NO. 2
TRIP LOG
CALIFORNIA POTATO TRANSPORTATION TEST 1 - 1948
BAKERSFIELD, CALIFORNIA TO NEW YORK CITY
MAY 21-30, 1948
VIA SANTA FE - PENNSYLVANIA RAILROAD

May	Station	Arrive	Depart	Temp. ° F.	Weather
21	California Loading Points			60-75	Partly Cloudy
22	Bakersfield, Cal.		1:45PM(PST)	85	Clear
"	Summit		5:30PM	68	"
"	Mohave	6:40PM	7:05PM	70	"
"	Barstow	9:45PM	10:45PM	67	"
23	Needles (icing)	6:00AM	8:20AM	65-81	"
"	Kingman, Ariz.		11:20AM		"
"	En route		1:00PM	92	"
"	Seligman	2:50PM	4:25PM(MST)	84	"
"	Ashfork	5:25PM	5:40PM		"
"	Williams	7:00PM	7:30PM	70	"
"	Flagstaff		9:00PM		"
"	Winslow (icing)	10:00PM	1:30AM	60	"
24	Gallup, New Mexico	6:30AM	8:35A M	52-60	Cloudy
"	Belen (icing)	1:00PM	5:50PM	69	Rain
"	Vaughn	9:30PM	9:55PM	50	Clear
25	Clovis	1:30AM	3:00AM(CST)		Clear
"	Amarillo, Texas	6:30AM	8:00AM	60	Overcast
"	Canadian, Texas	11:10AM	12:15AM		Overcast
"	Waynoka, Okla. (icing)	3:10PM	5:10PM	72	Overcast
"	Wellington, Kansas	8:55PM	10:05PM	61	Clear
26	Emporia	2:10AM	8:25AM	56	"
"	Argentine, Kansas (icing)	12:25PM	5:15PM	80	"
"	Marceline, Missouri	8:45PM	9:55PM	67	"
27	Chillicothe, Illinois	7:45AM	8:05AM	68	"

(Continued)

(Table No. 2 Continued)

May	Station	Arrive	Depart	Temp. ° F.	Weather
27	Streator, Illinois	9:25AM	9:55AM	80	Clear
"	Joliet, Illinois		12:30PM	85	"
"	McCook		2:30PM		"
"	Corwith (icing)	3:15PM	5:00PM	85	"
"	Clearing	6:00PM	6:00AM	56° Min.	"
28	59th St., Chicago	7:15AM	9:30AM	69	"
"	Dolton, Indiana	10:20AM	11:00AM	60	"
"	Logansport	1:45PM	2:30PM	85	"
"	Union City		8:00PM	70	"
"	Bradford, Ohio		9:55PM	-	"
29	Columbus (icing)	4:30AM(EST)	9:35AM	64	Overcast
"	Dennison		1:30PM	76	"
"	Stubenville		3:30PM	72	"
"	Pitcairn, Pennsylvania	6:30 PM	7:40PM	70	"
30	Altoona	6:45PM	8:00AM	61	Fog
"	Forge	8:30AM	8:40AM	66	Overcast
"	Huntingdon (icing)	9:25AM	10:10AM	70	"
"	Enola(Harrisburg), Pa.	1:00PM	2:50PM	75	"
"	En route		4:00PM	77 Max.	"
"	Meadows, New Jersey	9:30PM		66	Rain
"	Harismus Cove, New Jersey	10:00PM			"
31	New York City			63-66	Overcast
June 1 - New York City				61-75	Cloudy

CAR LOADING AND SHIPPING DATA TABLE NO. 3

KERN COUNTY, CALIFORNIA POTATO TRANSPORTATION TEST - 1 - 1948

BAKERSFIELD, CALIFORNIA TO NEW YORK CITY, MAY 21-30,1948 - SANTA FE - PENNSYLVANIA R.R.

Test Car	1	2	3	4	5	6	7	8	9	10	11
SFRD	34874	14488	35221	34315	32016	33083	35403	35616	4403	36586	33251
		Fans on							Fans on	1/	1/
ShippingPt.	WIBLE	LERDO	WIBLE	JASMINE	LERDO	SACO	WIBLE	SHAFTER	JASMINE	SACO	SACO
Load	360	360	360	360	360	360	360	360	360	3600	360
Bags	101 lbs.	101 lb.	101 lb.	101 lb.	101 lb.	101 lb.	101 lb.	101 lb.	101 lb.	10.1 lb	101 lb.
Billed Wt.	36360	36360	36360	36360	36360	36360	36360	36360	36360	36360	36360
Load	3 rows crosswise, 5 layers, 22 stacks with 30 bags set in doorway.										
Refrig.Rule	Std.Refrig.	Std.Refrig.	247	247	247	247	254	254	254	240	240
Cost $	101.20	101.20	61.99	61.99	61.99	61.99	68.31	68.31	68.31	43.01	46.56
Bunkers	Dry	Dry	Dry	Dry	Dry	Pre-iced	Pre-iced	Pre-iced	Pre-iced	Dry	Dry
Initial Ice	Bkrsfld	Bkrsfld	Needles	Bkrsfld	Bkrsfld	-	Repln.	Repln.	Repln.	Needles	Kans.Cy.
Re-ice	All stations	All stats.	Chicago	Kans.Cy.	Kans.Cy.	Belen	Kans.Cy.	Kans.Cy.	Kans.Cy.	None	None
Vents open to:	Bakersfield	Bkrsfld	Needles	Bkrsfld	Bkrsfld	Closed	Closed	Closed	Closed	Closed	Closed
Ice level when loaded:						Full	Full	Full	Full		
Loading:											
Started	2:25PM	1:30PM	1:40PM	9:00AM	1:00PM	10:00AM	1:00PM	8:45AM	10:30AM	2:00PM	9:30AM
Finished	3:30PM	2:05PM	2:25PM	10:00AM	1:40PM	3:30PM	1:45PM	11:00AM	11:30AM	3:00PM	6:00PM
Temp.during loading:											
Potato °F.	67	66	56	61	65	60	62	57	61	55 2/	50 2/
Outside°F.	69	70	69	67	69	73	71	64	65	74	74
Brand	Limestone	Campco	Limestone	JSO	Campco	Kitchen King	Limestone	JB	JSO	BIG B	BIG B

1/ Potatoes pre-cooled by shipper in cold water tank. 2/ 70° before pre-cooling.

TABLE NO. 4

PACKING HOUSE DATA

KERN COUNTY, CALIFORNIA POTATO TRANSPORTATION TEST - 1

BAKERSFIELD, CALIFORNIA TO NEW YORK CITY, MAY 21-30, 1948.

Test Car	1	2	3	4	5	6	7	8	9	10	11
Shed	Mettler Farms	S.A. Camp	Mettler Farms	J.S. Olive	S.A. Camp	Golding	Mettler Farms	Jacobsen	J.S. Olive	Bidart	Bidart
Place	Wible	Cawelo	Wible	Jasmine	Cawelo	Saco	Wible	Shafter	Jasmine	Saco	Saco
Grower	Clifford Mettler	Camp	Clifford Mettler	M.J. Schnaidt	Camp	Golding	Clifford Mettler	D. Fuller	H.J. Schnaidt	Bidart Bros	Bidart Bros.
Location	Wheeler Ridge	Cawelo	Wheeler Ridge	Jasmine	Cawelo	Wheeler Ridge	Wheeler Ridge	Minter	Jasmine	Saco	Saco
Planting Date	Jan.20	Feb.8	Jan.20	Jan.10	Feb.8	Dec.14	Jan.20	?	Jan.10	Jan.15	Jan.15
Water Off (Days)	14-16	5	14-16	10	5	10	14-16	6	10	10	10
Field Hauling	Bulk	Canvas Bags	Bulk	Burlap Bags	Canvas Bags	Canvas Barracks Bags	Bulk	Canvas Bags	Burlap Bags	Bulk	Bulk
Washer	Vat	Flood	Vat	Brush	Flood	Flood	Vat	Brush	Brush	Vat 1/	Vat 1/
Chlorinated Water	Yes	No	Yes	No	No	No	Yes	No	No	Yes	Yes
Wax	No	No	No	No	No	No	No	No	No	No	No
Pre-size belt	Wire	Wire	Wire	Wire	Wire	Wire	Wire	Wire	Wire	Wire	Wire
Skinning:											
Per cent lot	50	90	50	90	90	10	50	90	90	90	90
Surface skinned (%)	25	50-80	25	50-80	50-80	10-25	25	50-80	50-80	30-50	50-80
Surface browning (%)	0	0	0	0	0	0	0	0	0	0	0
Mechanical injury(%)	1.5	3.0	1.4	4.0	3.0	1.0	1.3	2.0	4.0	2.0	1.2
Decay	0	0	0	0	0	0	0	0	0	0	0
Greened (sunburn)	1.0	1.0	1.0	1.0	1.0	-	1.0	-	1.0	-	-

1/ Deep water vats cooled by Gen. Am. refrigeration system.

TABLE NO. 5

COMPARISON OF CONDITION OF POTATOES IN BOTTOM BUNKER AND TOP DOORWAY BAGS.

SUMMARY OF TEST LOTS

Car	Refrigeration	Position	Inspection Upon Arrival New York City 1/ 2/ Browning Severe Lbs.	Browning Moderate Lbs.	Skin 3/	Inspection After two to three days 1/ 2/ Browning Severe Lbs.	Browning Moderate Lbs.	Skin 3/
1	Std. Refrig.	Top D.	4.8	30.0	Good	15.8	37.0	Poor
		Bot.B	2.2	12.1	Good	6.0	41.2	Good
2	Std. Refrig.	Top D.	7.8	23.8	Good	27.2	30.8	Good
	Fans On	Bot.B. 4/	12.3	16.9	Good	12.3	24.1	Poor
3	Rule 247; iced	Top D.	5.0	29.0	Poor	11.8	38.4	Poor
	Needles & Corwith	Bot.B.	9.4	16.3	Good	19.8	35.0	Poor
7	Rule 254; pre-iced car.	Top D	3.8	27.6	Poor	8.6	55.2	Poor
	Replenished Bkrsfield Re-iced Argentine	Bot.B	6.3	20.0	Good	14.0	26.6	Poor
10	Hydro-cooled	Top D	4.6	28.8	Good	15.4	46.0	Good
	Rule 240;iced Needles	Bot.B 4/	0	0	Good	18.9	26.1	Good

1/ Practically no decay.
2/ Samples adjusted to 100 lb. basis.
3/ Good signifies pliable and adhering; poor signifies brittle and papery.
4/ Tubers not from same field as the rest.

TABLE NO. 6

WEIGHT LOSS 1/

Car	Refrigeration	Bag	Weight California 5/21 Pounds	Loss New York 6/2 Pounds	Loss New York 6/2 Pct.	Loss New York 6/4 Pounds	Loss New York 6/4 Pct.
1	Std. Refrig.	1	54.0	1.90	3.56	2.4	4.4
		2	53.3	1.50	2.81	2.1	3.9
		3	53.5	1.75	3.27	2.4	4.5
		Average		1.72	3.21	2.3	4.3
3	Rule 247 - Iced at Needles and Corwith.	4	53.2	1.70	3.19	2.2	4.1
		5	54.94	1.94	3.53	2.4	4.4
		6	53.4	1.80	3.37	2.3	4.3
		Average		1.81	3.35	2.3	4.3
7	Rule 254 - Pre-iced, Replen.Bkrsfld.	7	54.06	1.26	2.33	1.8	3.3
	Re-iced Argentine,Kansas	8	55.06	1.31	2.38	1.8	3.3
		9	53.94	1.24	2.30	1.8	3.3
		Average		1.27	2.34	1.8	3.3
10	Rule 240 - Hydro-cooled Potatoes	10	54.00	.70	1.30	1.5	2.8
	Vents closed, Initial ice Needles	11	52.12	.72	1.38	1.2	2.3
		12	53.60	.70	1.31	1.6	3.0
		Average		.71	1.33	1.30	2.7
2	Fan Car - Fans On	13	53.20	1.6	3.01	2.4	2.7
	Std. Refrig.	14	53.80	1.6	2.97	2.2	4.1
		15	55.50	1.9	3.42	2.6	4.7
		Average		1.7	3.13	2.4	4.3
9	Fan Car, Fans On	16	53.40	1.70	3.19	2.6	4.9
	Pre-Replu. Bakersfield	17	53.25	1.25	2.35	2.0	3.8
	Re-Ice Argentine, Kansas	18	53.80	1.30	2.42	2.2	4.1
		Average		1.42	2.66	2.3	4.3

1/ Weight of bag (tare) - .35 lbs. disregarded.

TABLE NO. 7

ICING RECORD

CALIFORNIA POTATO TRANSPORTATION TEST - 1 - 1948

BAKERSFIELD, CALIFORNIA TO NEW YORK CITY, MAY 21-30, 1948

ROUTE: SANTA FE - PENNSYLVANIA RAILROAD

Car			1	2 1/	3	4	5	6	7	8	9 1/	10	11
SFRD			34874	14488	35221	34315	32016	33083	35403	35616	4403	36586	33251
Rule 2/			Std. Refrig.	Std. Refrig.	247	247	247	247	254	254	254	240 3/	240 3/
ICE SUPPLIED BEFORE LOADING (Pre-icing)													
Bkrsfld	May 20	7:00P						11,500 4/	11,500 4/	11,500 4/	11,500 4/		
ICE SUPPLIED AFTER LOADING													
Bkrsfld	22	11:30A	11,500	11,500 4/		11,500 4/	11,500 4/		3,750	5,100	3,000		
NEedles	23	6:00 A	2,100	2,325	11,500			(1/3Full)	(7/8Full)	(7/8Full)	(3/4Full)	11,500 4/	
Winslow	24	12:30A	2,300	1,800									
Belen	24	2:00 P	1,000	1,400	(2/3Full)	(1/3Full)	(1/2Full)	6,600	(1/2Full)	(1/2Full)	1/3Full)	(2/3Full)	
Waynoka	25	4:15 P	1,700	3,000									
Argentine	26	2:00 P	800	1,250	(1/3Full)	6,700	7,500	(7/8Full)	5,900	5,800	7,200	(1/2Full)	11,500 4/
Corwith	27	4:30 P	1,800	2,400	7,200			(2/3Full)				(1/3Full)	
Columbus	29	7:00 A	1,900	1,900	(2/3Full)	(2/3Full)	(5/8Full)	(1/2Full)	(1/2Full)	(2/3Full)	(2/3Full)	(1/4Full)	(1/3Full)
Hungdn	30	10:00A	1,300	1,300	(3/4Full)	(5/8Full)	(1/2Full)	(3/8Full)	(3/8Full)	(3/4Full)	(5/8Full)	(1/8Full)	(1/4Full)
TOTAL			24,400	26,875	18,700	18,200	19,000	18,100	21,150	22,400	21,700	11,500	11,500
New York,N.Y. Remaining 5/	31	6:00 P				5,700					5,700		2,900
* June	1	7:00 P								5,000			
* June	2		9,500	8,625	5,200		5,700	3,600	2,500			500	
Ice Melted			14,900	18,250	13,500	12,500	13,300	14,500	18,650	17,400	16,000	11,000	8,600

Footnotes for Icing Record

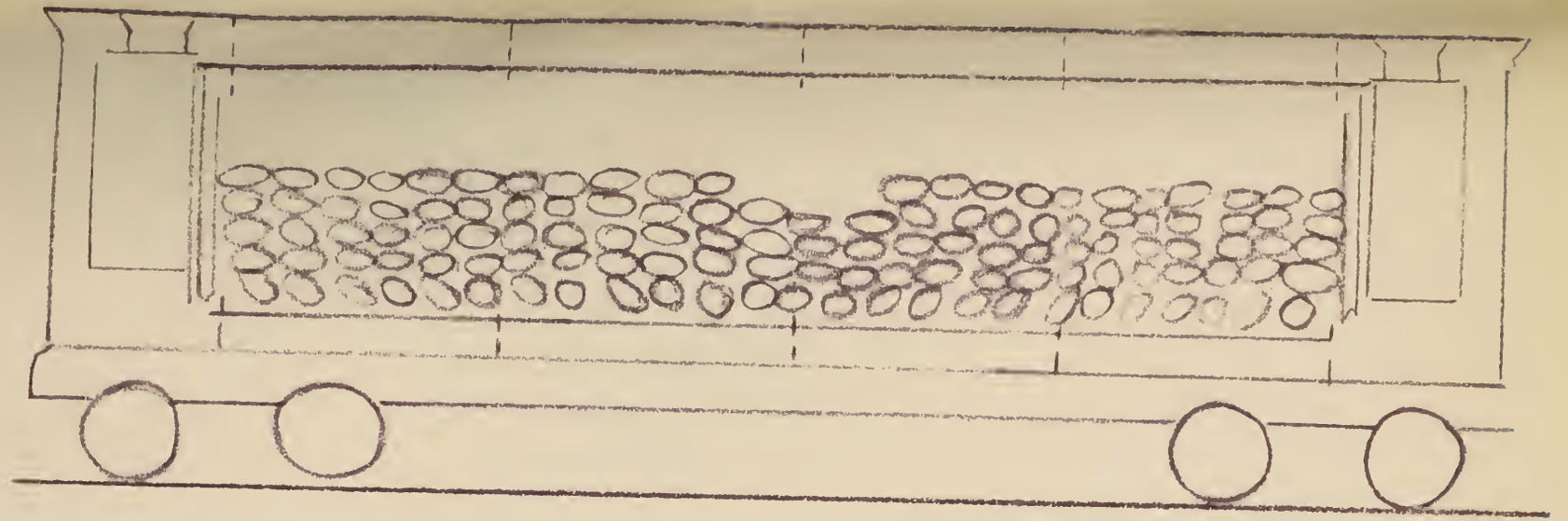
1/ Fan car - fans on (Car 9 - Rear fan off - drive wheel broken - Waynoka, Okla. to New York City).

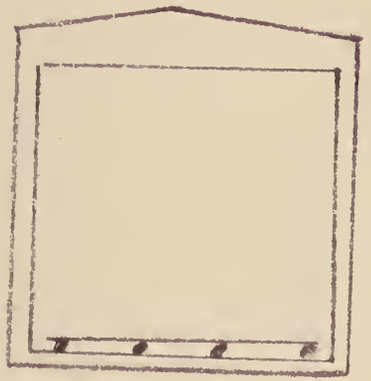
2/ Vents open until initial icing.

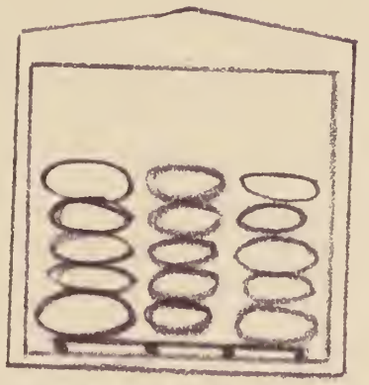
3/ Pre-cooled (Hydro-cooled) Load shipped vents closed in "dry" cars.

4/ Initial icing.

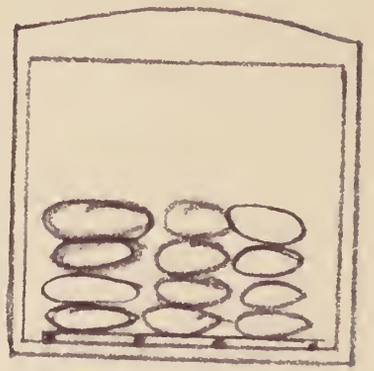
5/ Estimated from depth of ice.







11 Stacks, 5 High
Each End of Car



3 Stacks Doorway

Figure No. 1

Loading Plan - California Potato Test 1948 - 1
3 x 5 "Bumped"Load. 360 - 100 Lb. Burlap Bags

FIGURE NO. 2
CALIFORNIA POTATO TEST 1 - MAY, 1948
CAR 1 - SFRD-34874
DRY CAR LOADED - STD. REFRIG.

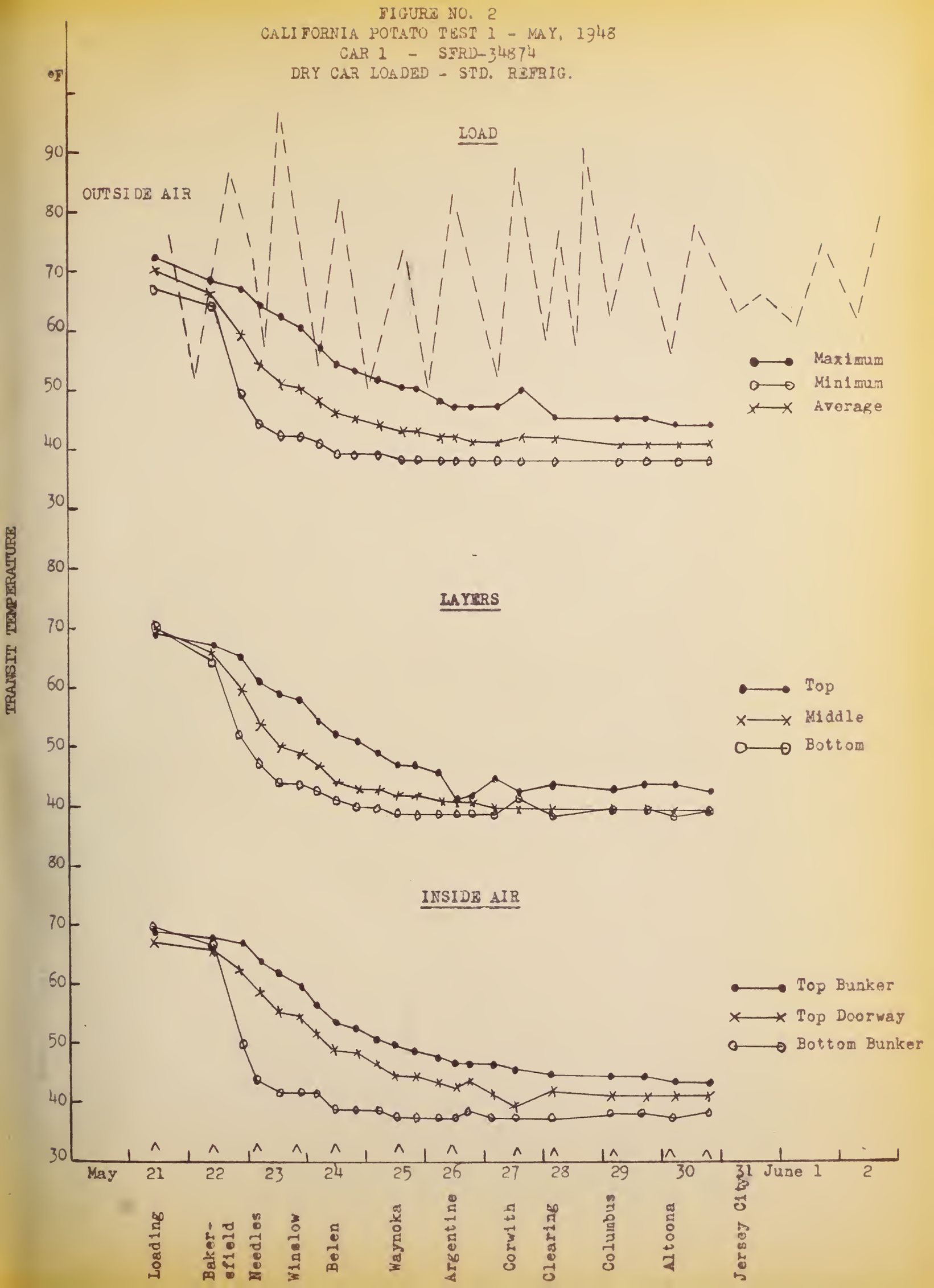


FIGURE NO. 3
CALIFORNIA POTATO TEST 1 - MAY, 1948
CAR 2 - SFRD 14488 FAN CAR
DRY CAR LOADED - STD. REFRIG. - FANS ON

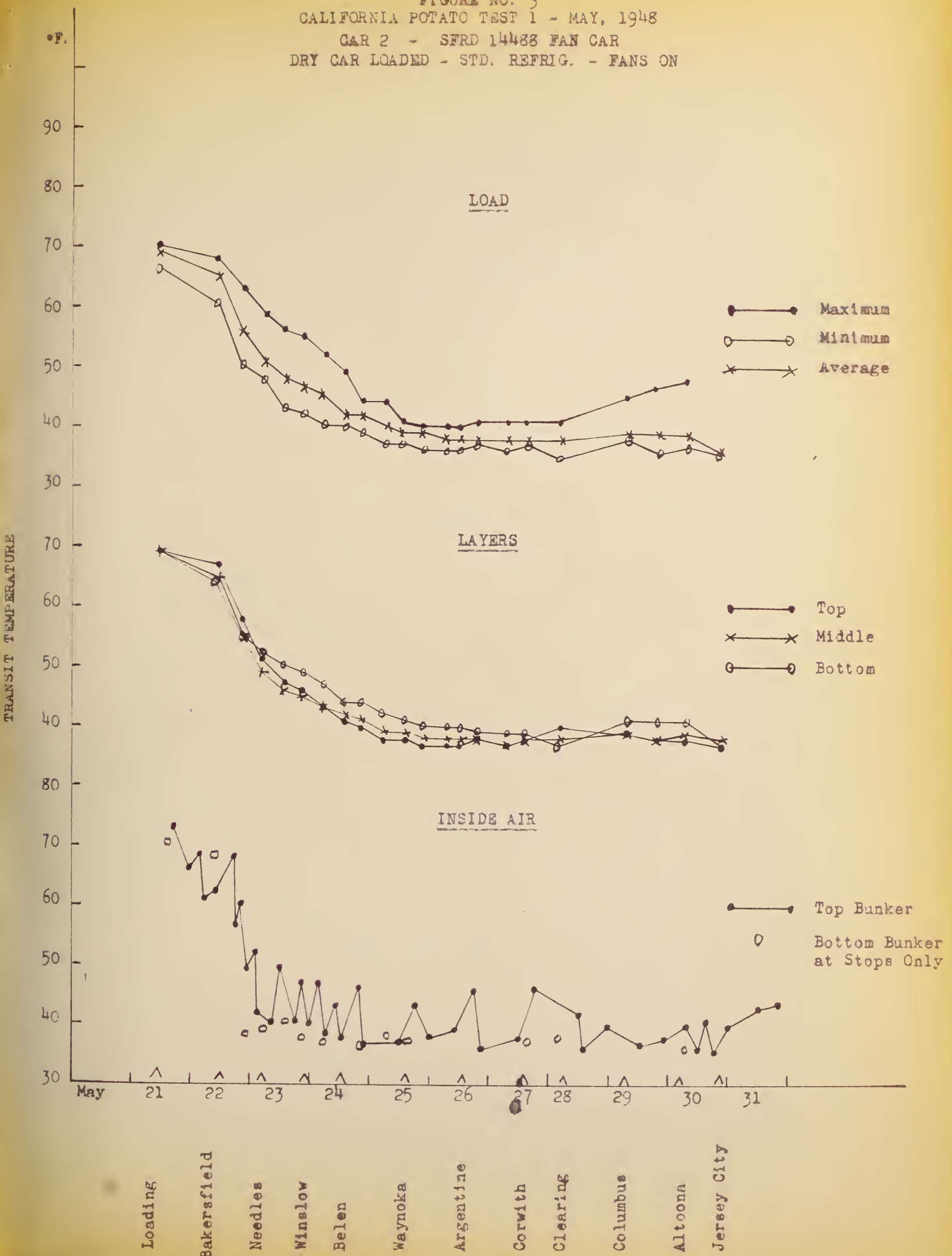


FIGURE NO. 4
CALIFORNIA POTATO TEST 1 - May, 1948
CAR 3 - SFRD-35221
RULE 247 - ICED NEEDLES AND CORWITH

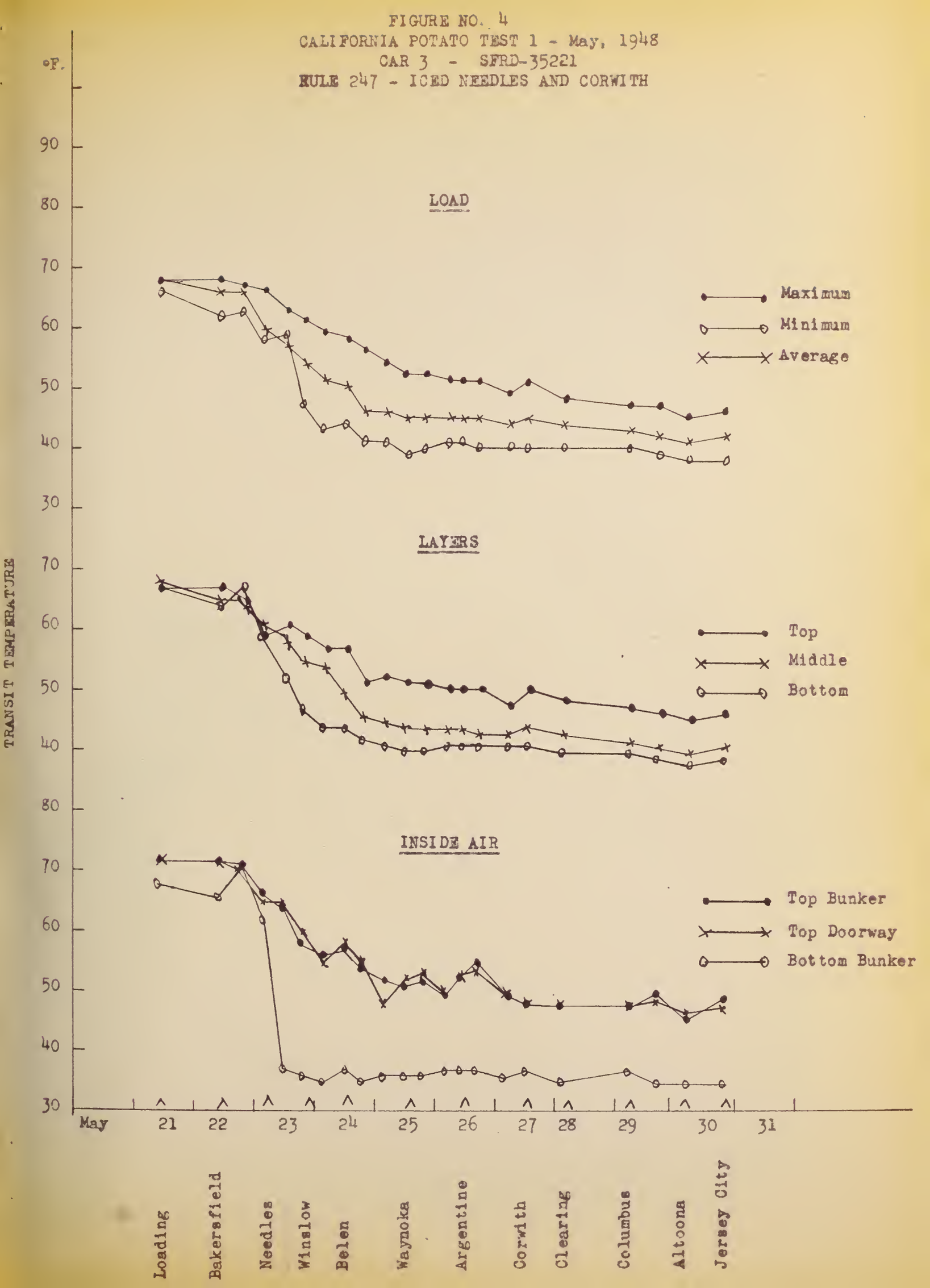
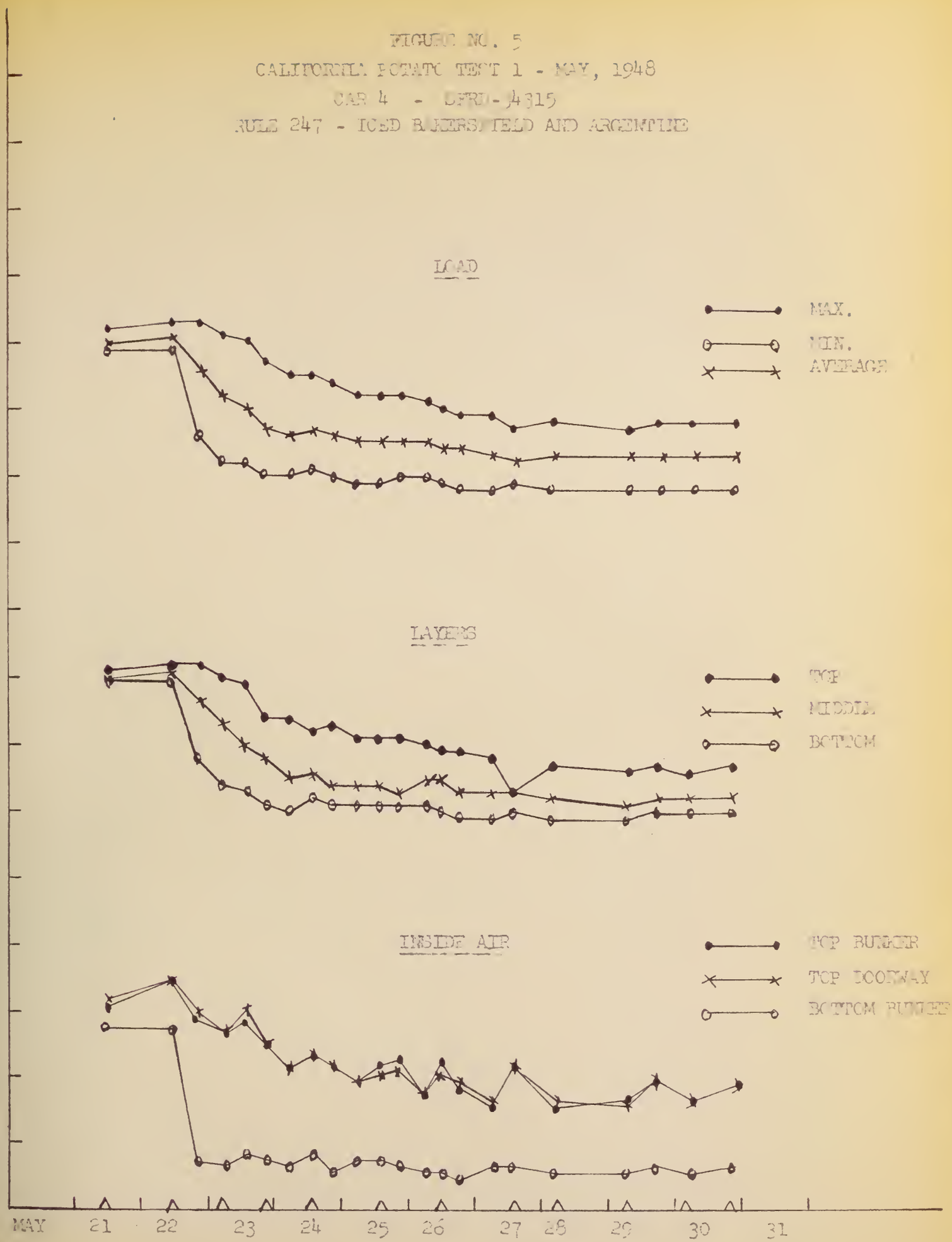


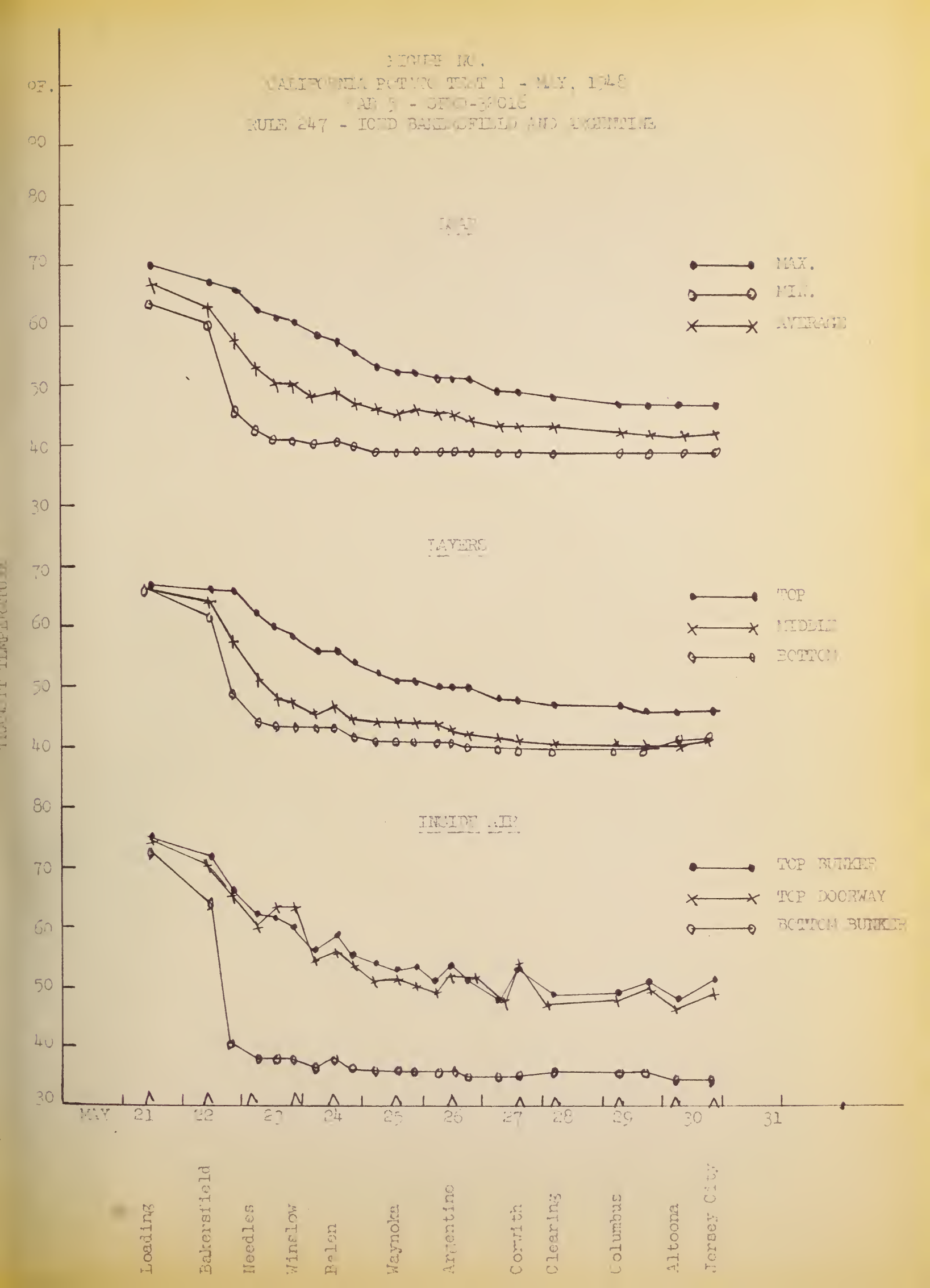
FIGURE NO. 5

CALIFORNIA POTATO TEST 1 - MAY, 1948

CAR 4 - DFRD-4315

RULE 247 - ICED BAKERSFIELD AND ARGENTINE




MAY
MAX.
MIN.
AVERAGE
LAYERS
TOP
MIDDLE
BOTTOM
INSIDE AIR
TOP BUNKER
TOP DOORWAY
BOTTOM BUNKER
MAY 21 22 23 24 25 26 27 28 29 30 31
Loading
Bakersfield
Needles
Winslow
Belen
Waynoka
Argentine
Corrith
Clearing
Columbus
Altoona
Jersey City

MAX.
MIN.
AVERAGE
TOP
MIDDLE
BOTTOM
TOP BUNKER
TOP DOORWAY
BOTTOM BUNKER
MAY
21
22
23
24
25
26
27
28
29
30
31
Loading
Bakersfield
Needles
Winslow
Belen
Jaynoka
Argentine
Corwith
Clearing
Columbus
Altoona
Jersey City

FIGURE NO. 8
CALIFORNIA POTATO TEST 1 - MAY, 1948
CAR 7 - SFRD-35403
RULE 254 - PRE-ICED CAR
REPLENISHED BAKERSFIELD, RE-ICED ARGENTINE

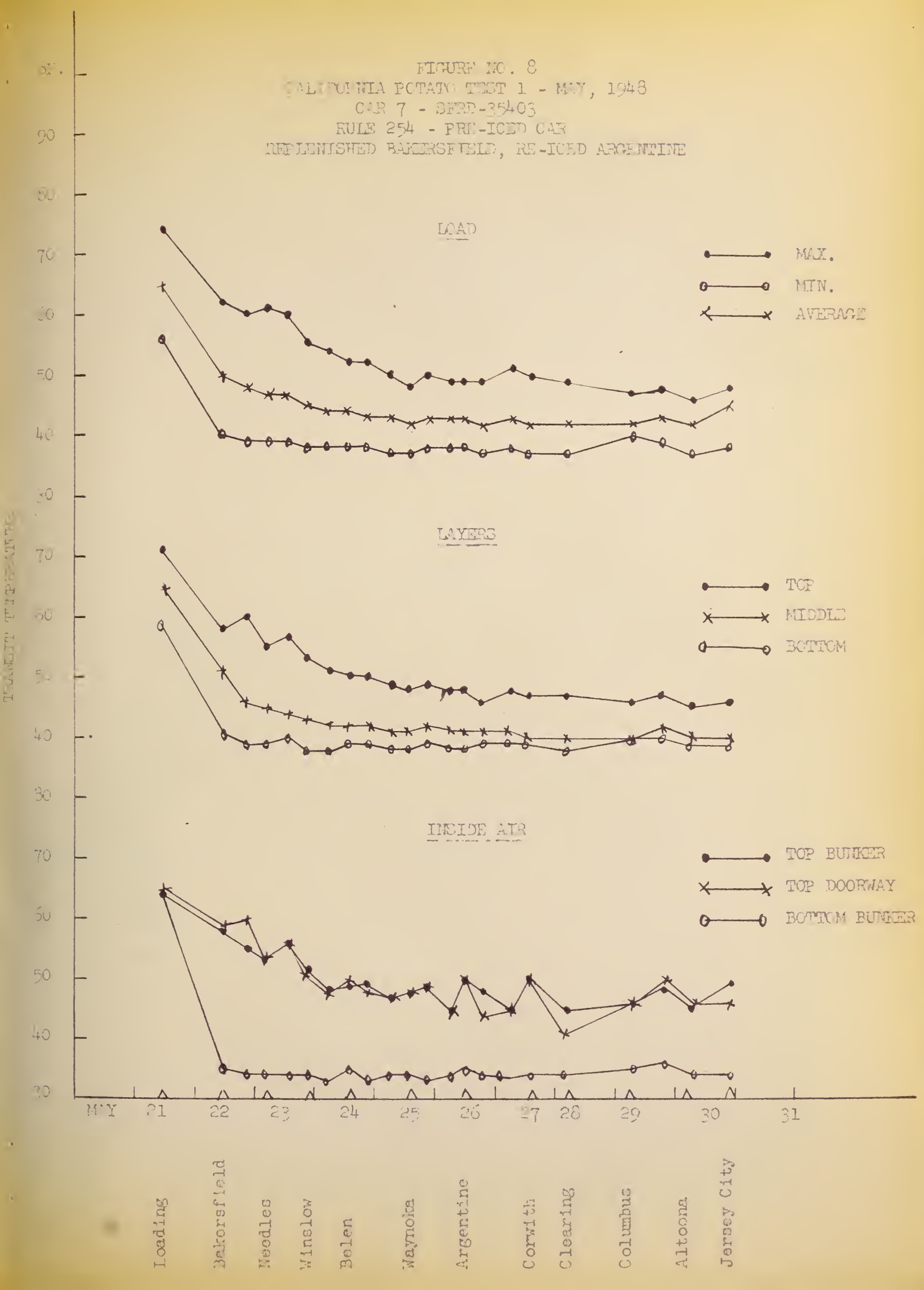


FIGURE NO. 9
CALIFORNIA POTATO TEST 1 - MAY, 1948
CAR 8 - SFRD-35616
RULE 254 - PRE-ICED CAR
REPLENISHED BAKERSFIELD, RE-ICED ARGENTINE

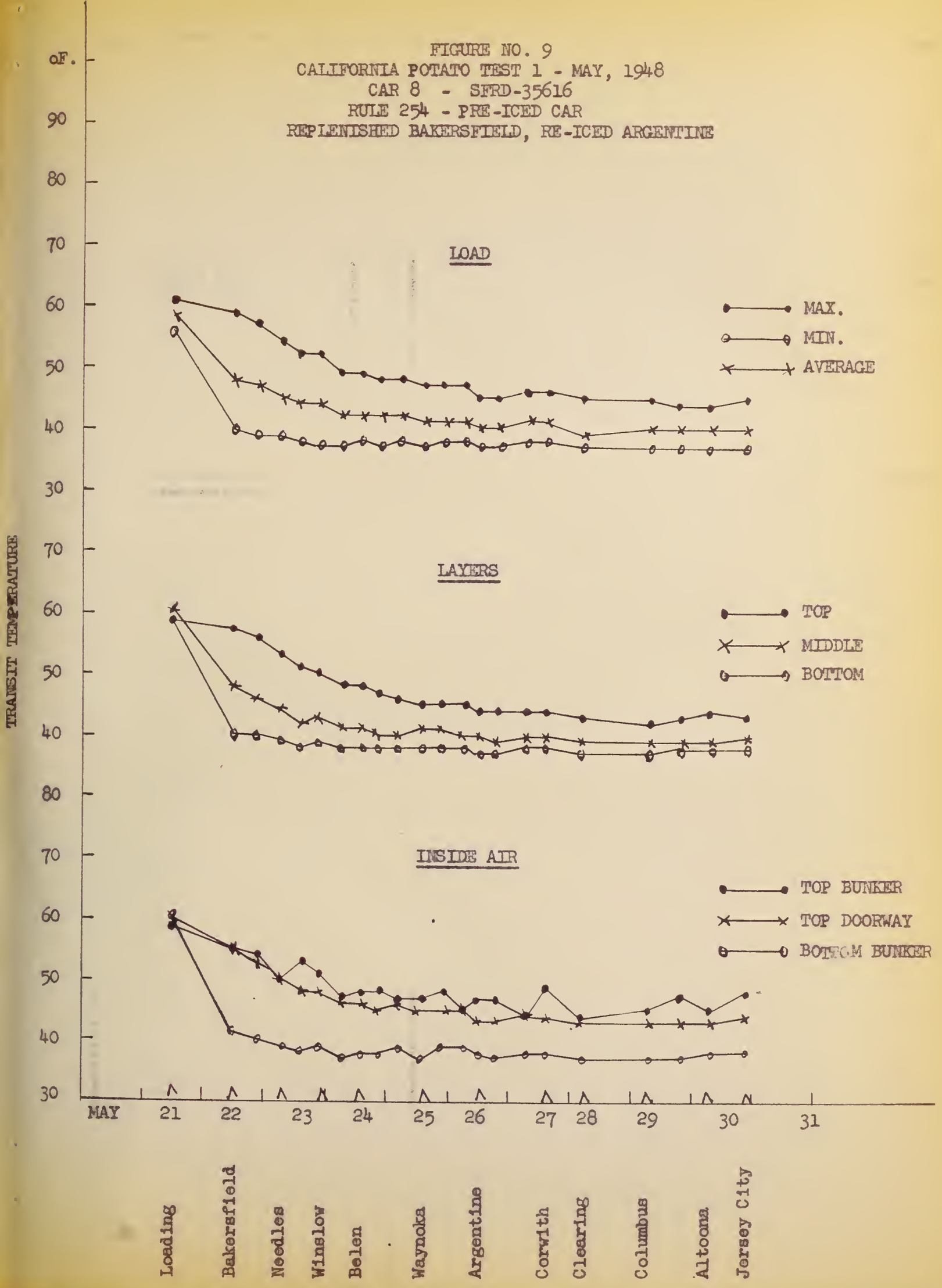


FIGURE NO. 10
CALIFORNIA POTATO TEST 1 - MAY, 1948
CAR 9 - SFRD-4403 FAN CAR
RULE 254 - PRE-ICED CAR
REPLENISHED BAKERSFIELD
RE-ICED ARGENTINE - FANS ON

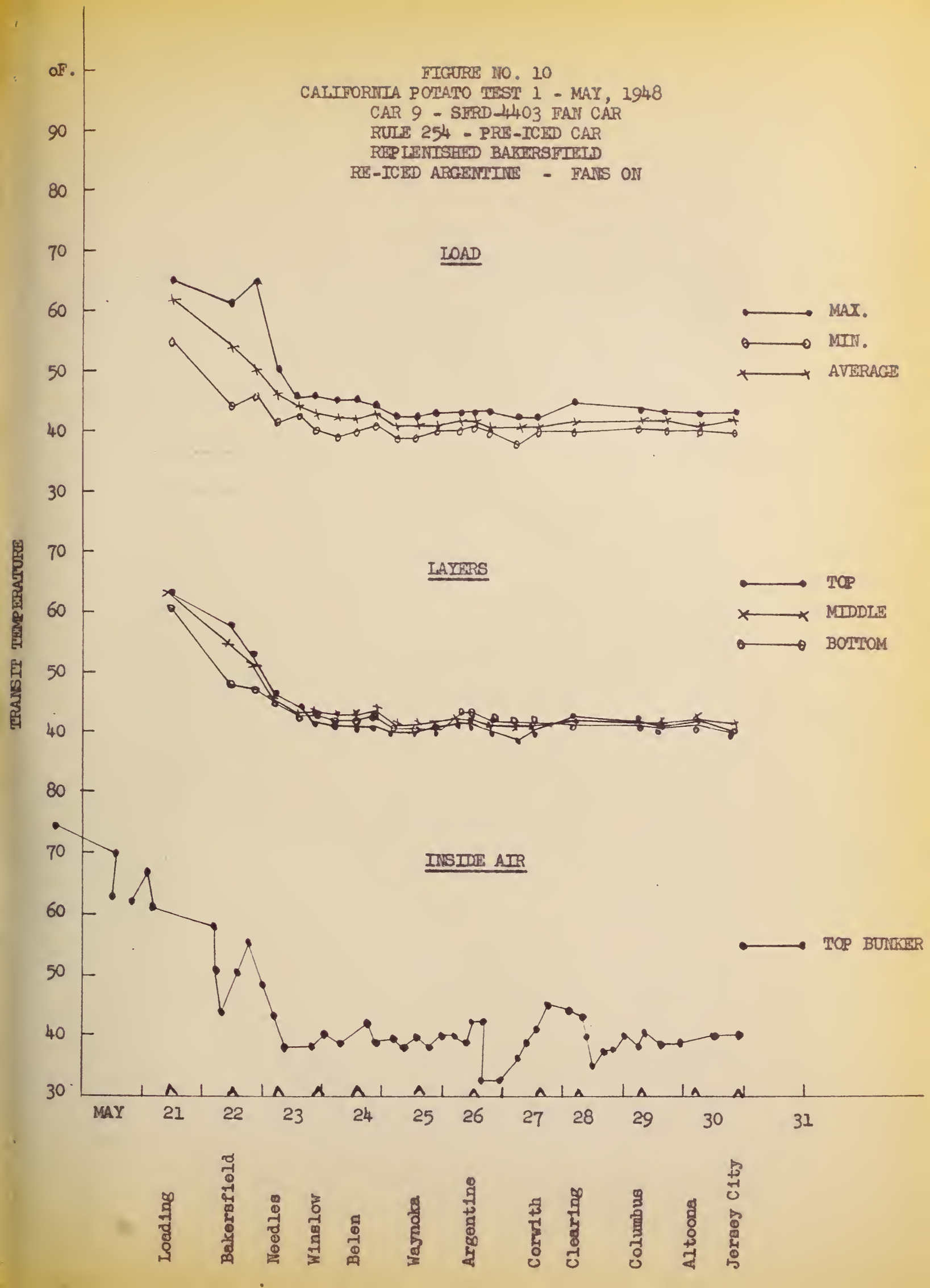


FIGURE NO. 11
CALIFORNIA POTATO TEST 1 - MAY, 1948
CAR 10 - SFRD -36586
RULE 240 - HYDRO-COOLED LOAD
VENTS CLOSED
ICED AT NEEDLES

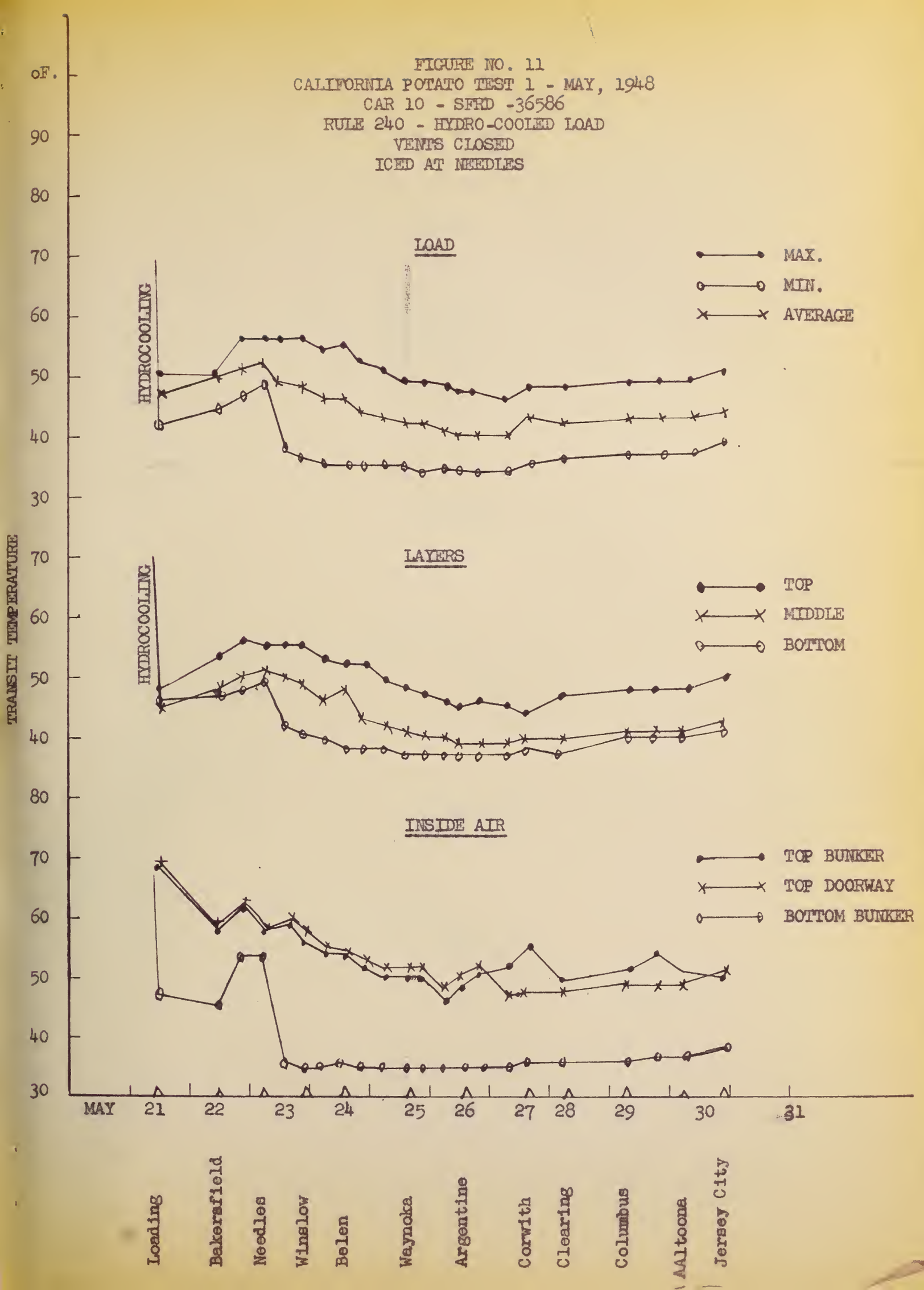


FIGURE NO. 12
CALIFORNIA POTATO TEST 1 - MAY, 1948
CAR 11 - SFRD-33251
RULE 240 - HYDRO-COOLED LOAD
VENTS CLOSED
ICED AT ARGENTINE

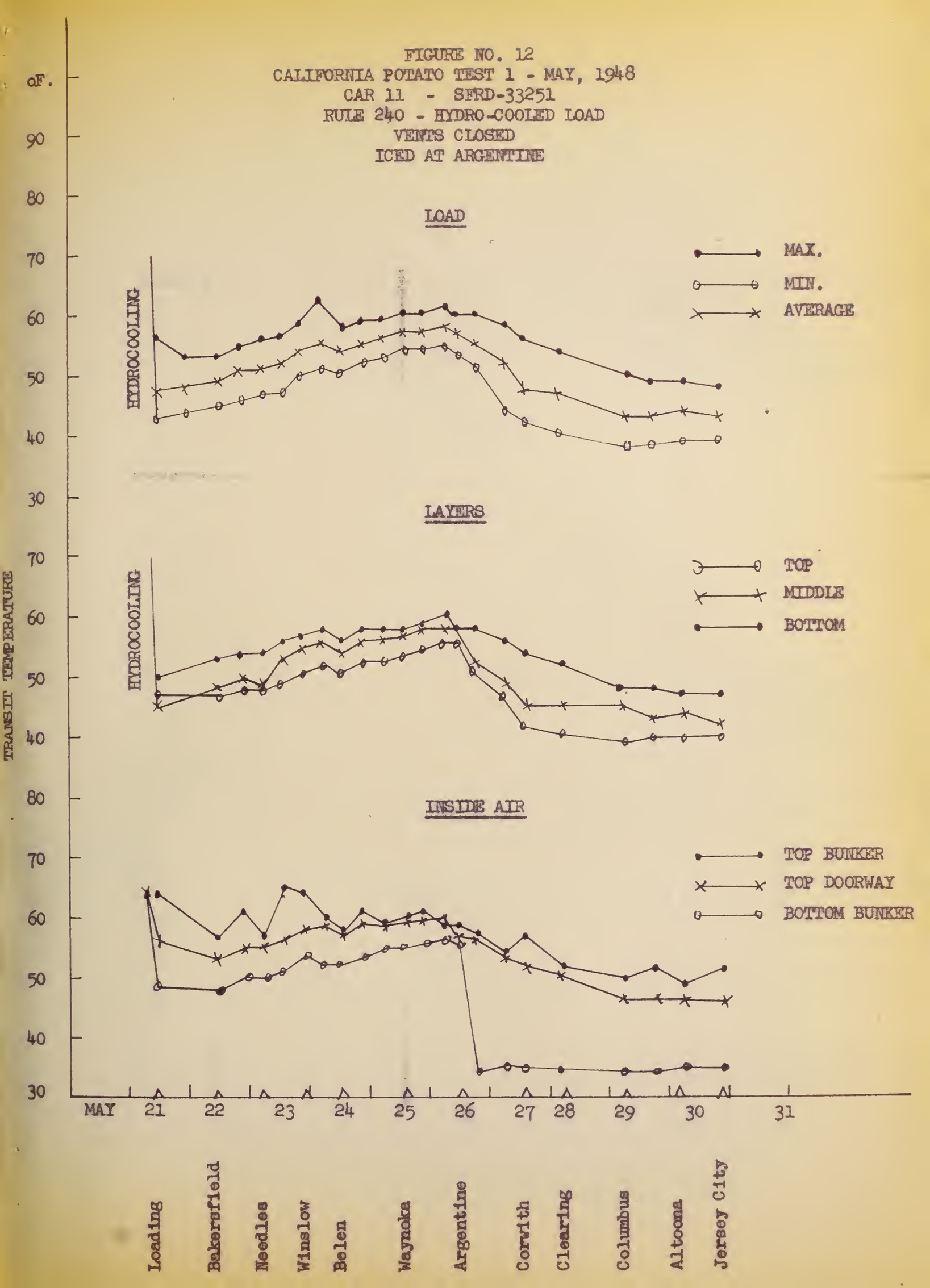


FIGURE NO. 13
CALIFORNIA POTATO TEST 1 - MAY, 1948
BAKERSFIELD TO NEW YORK CITY

AVERAGE LOAD TEMPERATURE OF CARS

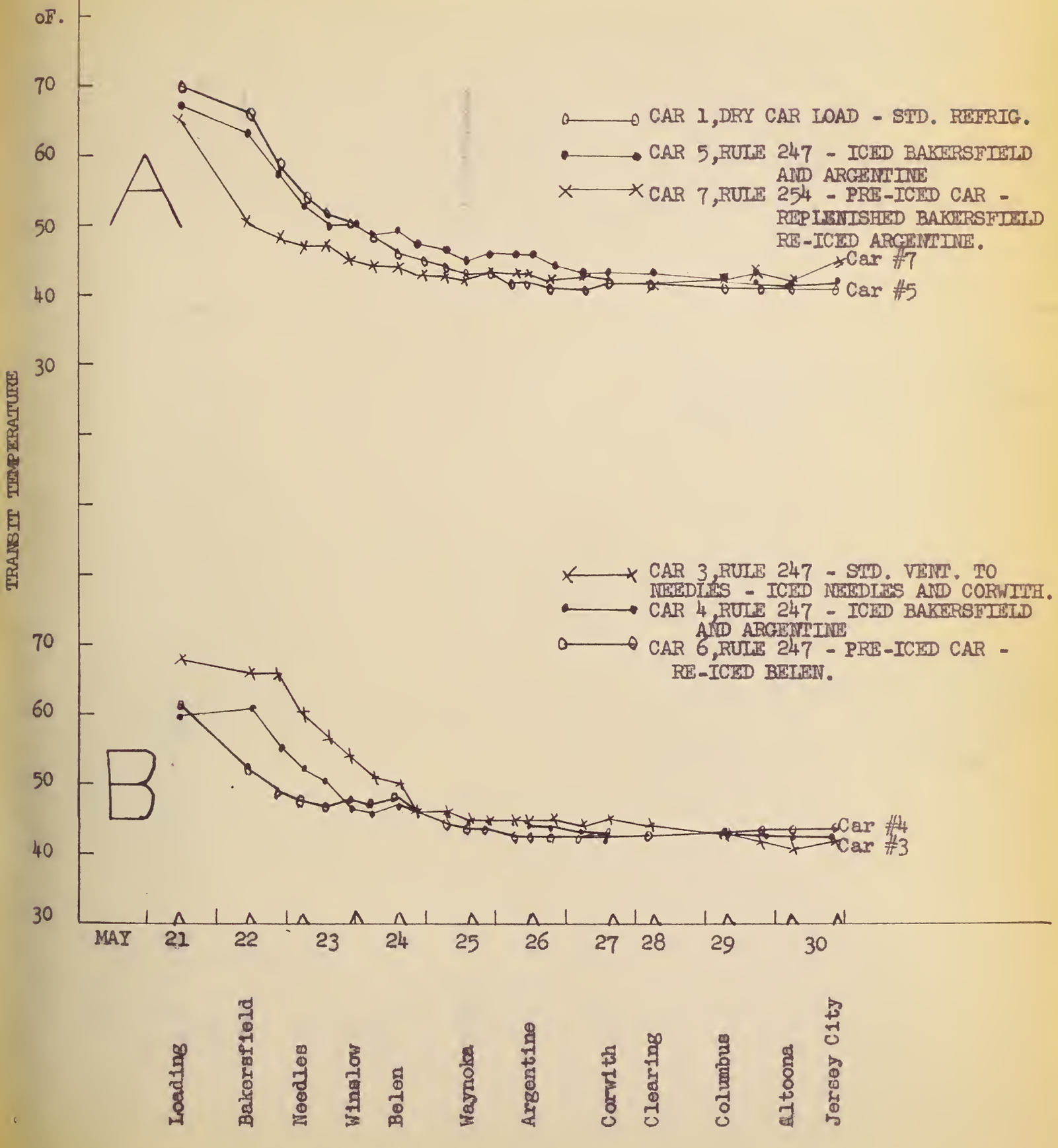


FIGURE NO. 14
CALIFORNIA POTATO TEST 1 MAY, 1948
BAKERSFIELD TO NEW YORK CITY

AVERAGE LOAD TEMPERATURE OF CARS

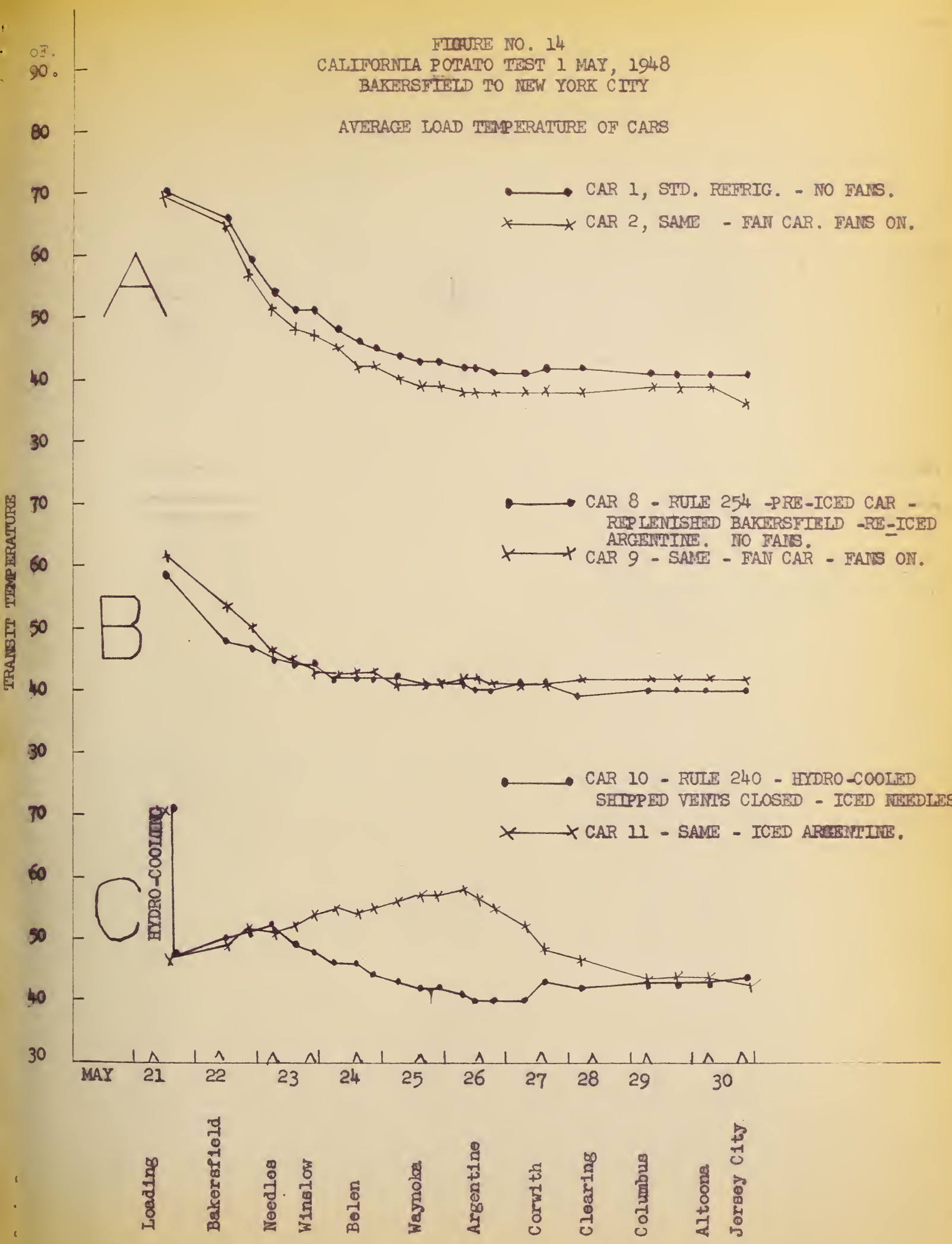
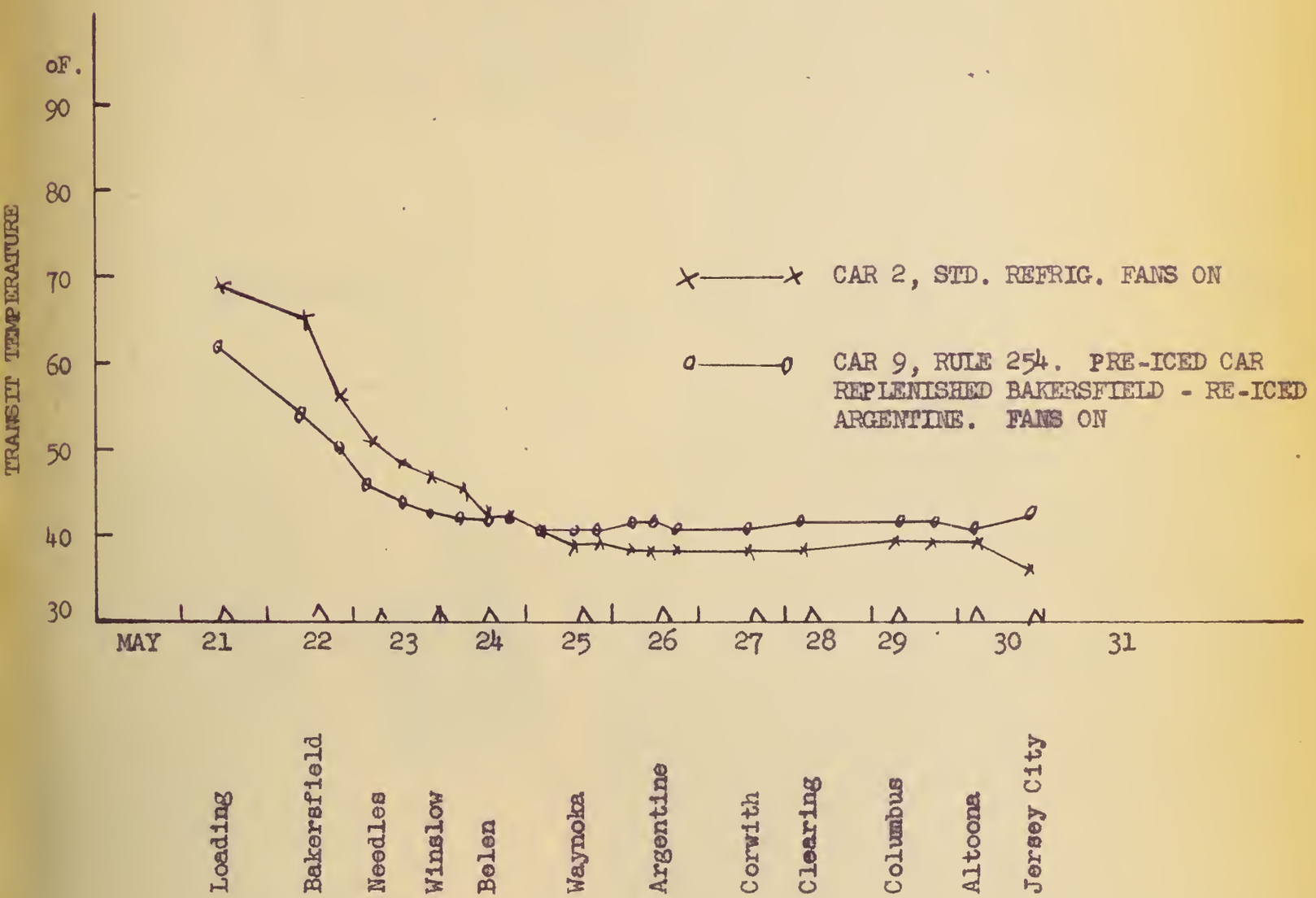


FIGURE NO. 15
CALIFORNIA POTATO TEST 1 - MAY, 1948
BAKERSFIELD TO NEW YORK CITY

AVERAGE LOAD TEMPERATURE OF CARS